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Response of Soil Application of Diatomaceous Earth as a Source of Silicon on Leaf Nutrient Status of Guava

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An experiment was carried out in Kittur Rani Channamma College of Horticulture, Arabhavi, Belgaum District, Karnataka state to know the response of soil application of diatomaceous earth (DE) as a source of silicon on leaf nutrient status of guava. Leaf sample under different treatment were collected and utilized for analysis of nutrient status. The highest macronutrient *viz*., Nitrogen (2.13%), Phosphorous (0.32%) and Potassium (0.65 %) were recorded in plants applied with Half of RDF, Recommended dose of fertilizer (RDF), Half of RDF,RDF + 1kg/plant of DE, and RDF + 3kg/ plant of DE and RDF + 3kg/ plant of DE respectively. The Micronutrients of guava leaves *viz.*, Calcium (1.39%), Magnesium (0.44%), Zinc (77.55 ppm), Iron(136.58), Silicon (0.45%), manganese (260.53), and Copper (67.45 ppm) were also recorded in plants applied with RDF + 3kg/plant DE.

Introduction

The crop production of guava can be increased by balanced nutrition on profitable basis even though it is growing in the tropical condition. The growth, yield and quality of guava can be increased by application of manures and fertilizers as it respond to application of fertilizers. Among the plants, silicon concentration is found to be higher in monocotyledons than in dicotyledons and its level increased from legumes < fruit crops < vegetables < grasses < grain crops. The role of silicon in plant biology is to reduce multiple stresses including biotic and abiotic stresses. It is also known to increase drought tolerance in plants by maintaining plant water balance, photosynthetic activity, erectness of leaves and structure of xylem vessels under high transpiration rates (Melo *et al.*, 2003). Silicon application improved water economy and dry matter yield (Gong *et al.*, 2003). It enhanced the leaf water potential under water stress conditions, reduced the incidence of micronutrient and metal toxicity (Matoh *et al.*, 1991). The presence of Silicon also been reported to affect the absorption and translocation of several macro and micro-nutrients. Si is accumulated in plants to total concentrations in dry matter similar to those of essential macro-nutrients such as Potassium, Calcium, Magnesium, Sulphur and

Phosphorous (Epstein, 1999). More recently, silicon amendments were shown to reduce the leaching of phosphate, nitrate and potassium (Matichenkov and Bocharnikova, 2010).

With this brief information and based on the possible benefits of silicon, the present study was carried out to know the Response of Soil Application of Diatomaceous Earth as a Source of Silicon on Leaf Nutrient Status of Guava.

Materials and Methods

Experiment was carried out in an established guava orchard of 6 years old plants with spacing of 6 m x 6 m. The source of silicon used is Diatomaceous earth (DE), applied as basal dose to the respective treatment in this experiment. The dosage of DE used in this experiment was 1, 2 and 3 kg/plant.

The inorganic nutrient *i.e.* nitrogen was applied in the form of urea (46% N), phosphorous in the form of single super phosphate and potassium in the form of muriate of potash (60% K). These nutrients were applied to the respective treatment according to the package of practice of UHS; Bagalkot (200:80:150g NPK/plant), (Anon, 2015). The design adopted for the experiment was Randomized Block Design (RBD) with nine treatments and three replications. The treatments are

T_1 - Absolute control,
T_2 - Recommended dose of fertilizer (RDF) @ 200:80:150 g NPK/plant,
T_3 - Half of RDF,
T_4 - Half of RDF + 1kg/plant of Diatomaceous Earth (DE),
T_5 - Half of RDF + 2kg/plant of DE,
T_6 - Half of RDF + 3kg/ plant of DE,
T_7 - RDF + 1kg/plant of DE,
T_8 - RDF + 2kg/plant of DE,
T_9 - RDF + 3kg/ plant of DE

Leaf sampling and processing

Leaf samples were collected from the designated plants of Leaf samples (8^{th} leaf) of each treatment in each replication after 4 months of bahar treatment. After cleaning with distilled water, leaf samples were oven-dried at 50^0C till they attain constant weight and analysed for nutrient status. The samples were analysed for total nitrogen, phosphorous, potassium, and micronutrients like, Calcium Magnesium, Zinc, Iron, Silicon, manganese, and Copper content. Estimation of total nitrogen, phosphorous and potassium were analysed as per the procedure given by Jackson, 1967. Calcium and magnesium were analysed as per the procedure given by titration with EDTA (disodium di hydrogenethylene diamine tetraacetate) which was reported by Tucker and Kurtz (1960). Zinc and Copper content was estimated by Diethylene triamine pentaacetic acid (DTPA) method (Lindasayand Norwell, 1978). Silicon content was estimated by ANSA (1-amino-2-napthol-4-sulfonic acid) method (Kadalli *et al*., 2013).

Results and Discussion

Effect of different treatments on nutrient content of leaves *viz.*, nitrogen, phosphorus, potassium, calcium, magnesium, zinc, iron and silica are presented in tables 1 and 2. The Nitrogen content in leaf was found non-significant in all the treatments. The higher value recorded in T_3 (2.16) and least the value recorded in T_6 (2.07). In case of Phosphorus content in leaf was found non significant. However higher value was recorded inT_2, T_3 T_7 and T_9 (0.32) and the least value was recorded in $T_1$and T_6 (0.29%). And also potassium content in guava leaves, there was non-significant difference among the different treatments. The maximum potassium content (0.65 %) was observed in T_9 (RDF + 3 kg/plant of DE), While minimum potassium content (0.56 %) was observed in T_1.

Table.1 Effect of diatomaceous earth (DE) on macro nutrient content of guava leaf

Treatments	N (%)	P (%)	K (%)
T_1 - Absolute control	2.14	0.29	0.56
T_2 - Recommended dose of fertilizer (RDF)	2.15	0.32	0.60
T_3 - Half of Recommended dose of fertilizer	2.16	0.32	0.60
T_4 - Half of RDF + 1 kg/plant of DE	2.13	0.30	0.63
T_5 - Half of RDF + 2 kg/plant of DE	2.12	0.30	0.62
T_6 - Half of RDF + 3 kg/plant of DE	2.07	0.29	0.61
T_7 - RDF + 1 kg/plant of DE	2.09	0.32	0.61
T_8 - RDF + 2 kg/plant of DE	2.11	0.30	0.54
T_9 - RDF + 3 kg/plant of DE	2.13	0.32	0.65
S.Em±			
CD @ 5%	**N.S**	**N.S**	**N.S**

N.S- Non significant

Table.2 Effect of diatomaceous earth (DE) on micro nutrient content of guava leaf

Treatments	Ca (%)	Mg (%)	Zn (ppm)	Fe (ppm)	Si (ppm)	Mn(ppm)	Cu (ppm)
T_1 - Absolute control	0.86	0.28	11.31	135.02	0.20	160.31	37.41
T_2 - Recommended dose of fertilizer (RDF)	0.94	0.31	11.81	117.53	0.22	181.63	30.73
T_3 - Half of Recommended dose of fertilizer	1.00	0.35	14.20	137.38	0.23	172.18	48.20
T_4 - Half of RDF + 1kg/plant of DE	1.10	0.37	12.83	134.78	0.32	221.38	65.18
T_5 - Half of RDF + 2 kg/plant of DE	1.18	0.37	16.06	124.71	0.30	218.50	33.48
T_6 - Half of RDF + 3kg/plant of DE	1.07	0.33	15.83	121.15	0.33	232.40	53.33
T_7 - RDF + 1 kg/plant of DE	1.22	0.36	16.20	113.78	0.29	239.76	61.48
T_8 - RDF + 2 kg/plant of DE	1.20	0.41	15.70	110.56	0.28	240.87	62.86
T_9 - RDF + 3 kg/plant of DE	1.39	0.44	17.55	136.58	0.45	260.53	67.45
S.Em±	**0.04**	**0.02**	**0.53**		**0.03**	**2.10**	**6.45**
CD @ 5%	**0.10**	**0.06**	**1.59**	**N.S**	**0.10**	**6.31**	**19.35**

N.S- Non significant

Micronutrients of guava leaves *viz.,* Calcium, Magnesium, Zinc, manganese, and Copper, there was significant difference among the different treatments. The maximum calcium content (1.39 %) was observed in T_9 (RDF + 3 kg/plant of DE), which was followed by treatment T_7 (1.22 %), while minimum calcium content (0.86 %) was observed in T_1 and it was found on par with T_2 (0.94%). The maximum magnesium content (0.44%) was observed in T_9 (RDF + 3kg/plant of DE), while minimum magnesium content (0.28 %) was observed in T_1. In case of zinc content of guava leaf the maximum zinc content (17.55 ppm) was observed in T_9 (RDF + 3kg/plant of DE), which was on par with treatment T_7 (16.20ppm), and T_5 (16.06 ppm). While minimum zinc content (11.31ppm) was observed in T_1 which was found on par with T_2 (11.81ppm). The maximum copper content (67.45ppm) was observed in T_9 (RDF + 3kg/ plant of DE), which was on par with treatment T_4 (65.18 ppm), T_8 (62.86ppm) and T_7 (61.48ppm) while minimum copper content (30.73ppm) was observed in T_2 which is found on par with T_5 (33.48ppm) and the Manganese content of leaves also found significant and the maximum content of manganese (260.53ppm) was noticed in treatment T_9 (RDF +3 kg/plant of DE), followed by T_8 (240.87ppm). While minimum manganese content (160.31 ppm) was observed in treatment T_1. This is due to silicon helps in more absorption of calcium, magnesium, zinc, manganese, and copper in to the plant tissue. Similar results were noticed by Lalithya *et al.,* (2014) in sapota, Bhavya (2010) in Bangalore Blue grapes, Stamatakis *et al.,* (2003) in tomato and Prado and Natale (2005) in passion fruit, Mary (2005) in rose, Kamenidou and Toddy (2008) in ornamental sunflower, Kamenidou *et al.,* (2009) in zinnia and Kamenidou *et al.,* (2010) in gerbera.

Iron content was found non significant difference among the different treatments with respect to iron content of leaf, however the maximum iron content (137.38 ppm) was observed in T_3 (RDF + 3 kg/plant of DE), While minimum iron content (110.56 ppm) was observed in T_8.

The maximum silicon content (0.45 ppm) was observed in T_9 (RDF + 3 kg/plant of DE), which was followed byT_6 (0.33 ppm) and T_4 (0.32 ppm). While minimum silicon content (0.20 ppm) was observed and it shows significant difference among the different treatments with respect to silicon content of leaf T_1. Application of higher dose of Diatomaceous Earth leads to more absorption on silicon by leaves of guava plants. The results are in conformity with findings of Lalithya *et al.,* (2014) in sapota, Bhavya (2010) in Bangalore Blue grapes, Savvas *et al.,* (2009) in tomato, Milne *et al.,* (2012) in lettuce, Kamenidou *et al.,* (2009) in gerbera and Mary (2005) in rose.

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